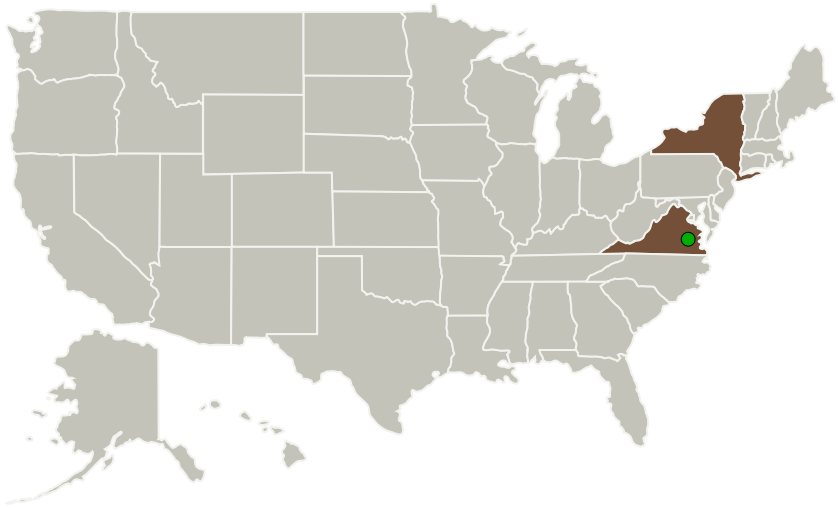
A Compact Safe Cold-Start (CS2) System for Scramjets using Dilute Triethylaluminum Fuel Mixtures, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

This proposal addresses the cold-start requirements of scramjet engines by developing a safe, energy-dense, and low volume hydrocarbon fuel conditioning system based on the hydrolysis reaction of water with triethylaluminum (TEA). TEA is an organometallic liquid that reacts exothermically with water and burns readily in air when not diluted in hydrocarbon mixtures. We propose to use the hydrolysis of nonpyrophoric dilute TEA/JP fuel mixtures in an integrated mixing/injection apparatus to heat and vaporize liquid hydrocarbon fuel to enable cold-start capability in regeneratively cooled scramjets. In addition, the hydrolysis reaction also produces ethane gas, which serves the dual purpose of atomizing any remaining liquid by effervescence as well as producing an ethane-rich injectant that is more readily ignitable than the vaporized JP fuel. Furthermore, since TEA is pyrophoric, any remaining TEA in the mixture could serve as an ignition aid once it comes in contact with air. Hence, through a straightforward hydrolysis mechanism, the proposed system would preheat and vaporize the fuel, atomize any remaining liquid through effervescence, add readily ignitable ethane to the mixture, and provide a potential ignition source with any TEA leftover from the hydrolysis reaction. The proposed Phase 1 and 2 research will result in the Compact Safe Cold-Start (CS2) system which will be a key enabling technology for future operational hypersonic vehicles.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
ACENT Laboratories LLC	Lead Organization	Industry	Manorville, New York
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
New York	Virginia

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139933)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ACENT Laboratories LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

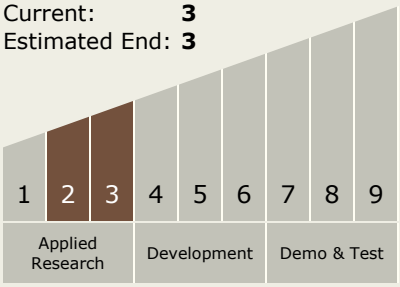
Carlos Torrez

Principal Investigator:

Scott Gallimore

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.2 Electrochemical: Fuel Cells

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System